

REMARKS

In response to the final Office Action dated January 20, 2004, Applicants file herewith a Request for Continued Examination pursuant to 37 CFR 1.114 and a Response and Amendment to the Office Action. Applicants respectfully request reconsideration. The application is believed to be in allowable condition.

Claims 1-3, 5, 10-13, 16-21, 23-30, and 32-35 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,072,815 (Peterson) in view of U.S. Patent No. 6,335,548 (Roberts). Claims 5, 21, and 35 have been canceled, making rejections as to these claims moot. Reconsideration of remaining rejections in view of the following remarks is respectfully requested.

Claim 1 is directed to a laser diode assembly for high output power applications. The assembly includes a carrier having a top and bottom, the top having a thermally conductive layer formed thereon, the thermally conductive layer sized for attaching at least two bonding members thereto, a laser diode having a top and bottom, the bottom of the laser diode being electrically coupled to the carrier, the top of the laser diode having first and second thermally conductive pads formed on opposing sides of the top, the first and second thermally conductive pads each sized for attaching at least one bonding member thereto, a first bonding member thermally coupling the first thermally conductive pad to the thermally conductive layer, and a second bonding member thermally coupling the second thermally conductive pad to the thermally conductive layer. At least one of the first and second bonding members carries an electrical signal.

Peterson discloses a submount assembly including a laser diode having a single electrical bonding pad for electrical connection. The laser diode is mounted on a thermal spreader that is then mounted on a metallization layer. Peterson also discloses use of a heat sink, such as a Peltier heat pump, below the laser diode for removing heat. Wire bonds can be added to electrically connect the upper surface of the laser diode and the metallization layer. The thermally conductive layer, or the metallization layer, in Peterson connects the bottom of the laser diode to the heat sink. Prior art laser diodes, such as Peterson, use a single conductive pad on the surface of the diode to achieve a connection.

Roberts discloses a light emitting diode (LED) used in a semiconductor optical radiation package. The LED chip includes the use of a number of top electrode bonding pads for attachment of wire bonds to provide redundant connection and decreased failure in the event of a wire bond break. Use of a plurality of redundant bond pads is generally used for larger LED chips, as discussed in Roberts.

Neither Peterson nor Roberts, alone or in combination, teaches or suggests a carrier having a top and bottom, the top having a thermally conductive layer formed thereon, the thermally conductive layer sized for attaching at least two bonding members thereto. Nor does the art teach or suggest the top of the laser diode having first and second thermally conductive pads formed on opposing sides of the top, as recited in claim 1. The first and second thermally conductive pads of the invention are each sized for the attachment of at least one bonding member, and at least one of the first and second bonding members carries an electrical signal, as also recited in claim 1. In both Peterson and Roberts, thermal dissipation is not an issue due to the very low power consumption. The invention of claim 1 is for high power semiconductor lasers, in which thermal management is critical.

Peterson does not teach or suggest a thermally conductive layer as recited in claim 1, which attaches to the bonding members. Roberts, like Peterson, does not teach or suggest using conductive pads, a conductive layer, and bonding members for thermal conduction. Roberts only relates to electrical connections to a radiation emitter. Further, since Roberts does not teach or suggest thermal control, it cannot be combined with Peterson to achieve the present invention.

Applicant respectfully traverses the claim rejections because the cited art does not disclose, teach or suggest the claimed features of the present invention. Furthermore, the cited art lacks any teaching or suggestion to combine the references in the manner suggested in the Office Action. The present claimed invention relates to a laser diode assembly having certain characteristics for thermal control. None of the prior art relates to thermal control. Peterson discloses a laser diode similar to that disclosed as prior art in Fig. 1 of the present application. It has a single electrical bonding pad for electrical connection. Thus, claim 1 is patentable for at least the reasons discussed herein. Claims 2-3, 10-13, 16-20, and 23-30 depend directly or indirectly from claim 1 and are patentable for at least the reasons that claim 1 is patentable. Claims 5 and 21 have been canceled, rendering rejections as to these claims moot.

Claim 32 is directed to a laser diode assembly. The assembly includes a carrier structured and arranged for mounting a laser diode chip thereto, the carrier comprising a first electrode area, a second electrode area, and a thermally conductive area, a laser diode having a first side attached to the second electrode area of the carrier and having a second side comprising first and second thermally conductive pads, a first bonding member coupling the first thermally conductive pad of the laser diode to the first electrode area of the carrier, and a second bonding member coupling the second thermally conductive pad of the laser diode to the thermally conductive area of the carrier.

As discussed above with respect to claim 1, neither Peterson nor Roberts discloses or suggests a laser diode having a first side attached to the second electrode area of the carrier and having a second side comprising first and second thermally conductive pads, a first bonding member coupling the first thermally conductive pad of the laser diode to the first electrode area of the carrier, and a second bonding member coupling the second thermally conductive pad of the laser diode to the thermally conductive area of the carrier, as recited in claim 32. Thus, claim 32 is patentable for at least the reasons discussed above with respect to claim 1.

Claim 33 is directed to a laser diode assembly. The assembly includes a carrier having a thermally conductive layer formed thereon, a laser diode electrically coupled to the carrier, and a means for transferring heat generated at the diode to the thermally conductive layer on the carrier, the means for transferring heat being thermally coupled to the carrier from the laser diode. The means for transferring heat comprises first and second thermally conductive pads disposed on a side of the laser diode and first and second bonding members coupling the first and second thermally conductive pads of the laser diode to the conductive layer on the carrier.

Claim 33 is patentable over Peterson in view of Roberts for at least the reasons discussed above with respect to claims 1 and 32. Claim 34 depends directly from claim 33 and is patentable for at least the reasons that claim 33 is patentable.

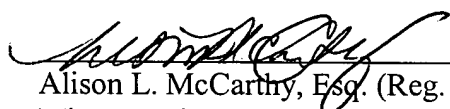
Claims 6-9 and 36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson and Roberts, and further in view of U.S. Patent No. 6,349,104 (Kato). Kato discusses a laser diode for use in radar systems designed to measure the distance to a target. The laser diode includes an upper electrode layer having a window and wires connected to the upper electrode layer on opposing sides of the window. Kato does not overcome the deficiencies of Peterson and

Roberts, discussed above with respect to claims 1 and 33. Claims 6-9 and 33 depend directly or indirectly from claim 1 and claim 33, respectively, and are patentable for at least the reasons discussed above with respect to claims 1 and 33.

Claims 14-15 and 22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Peterson and Roberts, and further in view of U.S. Patent No. 4,714,953 (Buller) or U.S. Patent No. 5,177,500 (Ng). Claim 22 has been canceled rendering rejection as to this claim moot. Buller discusses semiconductor packaging having aluminum wires to connect hot spots on chips to cooler portions of the package. Ng discusses an optical printhead with LED arrays having thermally conductive wires connecting adjacent LEDs to provide thermal distribution. However, neither of Buller and Ng overcomes the deficiencies of Peterson and Roberts discussed above with respect to claim 1. Claims 14 and 15 depend directly or indirectly from claim 1 and are patentable for at least the reasons that claim 1 is patentable.

Based on the foregoing, the application is believed to be in allowable condition, and a notice to that effect is respectfully requested. If the Examiner has any questions regarding the application, the Examiner is invited to contact the Applicants' Attorney.

Respectfully submitted,


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